

Citation:

Halton TL, Hu FB. The effects of high protein diets on thermogenesis, satiety and weight loss: a critical review. *J Am Coll Nutr*. 2004;23(5):373-85.

PubMed ID: [15466943](#)

Study Design:

Systematic Review

Class:

M - [Click here](#) for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To study the effects of high protein diets on dietary thermogenesis, satiety, body weight and fat loss.

Inclusion Criteria:

- The selection of articles was restricted to those in the English language.
- A total of 50 articles were included.
- Includes both a relatively higher protein and a lower protein diet and compares the effects of each on a variety of outcomes (total weight change, total body fat change, satiety and subsequent energy intake after an isocaloric preload).

Exclusion Criteria:

Article exclusion criteria not specifically mentioned.

Description of Study Protocol:**Recruitment**

- Relevant articles were identified by a search of the Medline database (National Library of Medicine, Bethesda, MD) using keywords such as ketogenic diet and weight loss.

Design: Systematic review

- Relevant articles were identified by a search of the Medline database (National Library of Medicine, Bethesda, MD) using keywords such as “ketogenic diet and weight loss.” Additional published reports were obtained by cross matching the references of relevant articles.
- Each study in this review includes both a relatively higher protein and a lower protein diet and compares the effects of each on a variety of outcomes (total weight change, total body fat change, satiety and subsequent energy intake after an isocaloric preload).

Blinding used (if applicable): not applicable

Intervention (if applicable)

The review includes relatively higher protein and a lower protein diet and in some studies protein diet was compared with high carbohydrate and high fat diets.

Statistical Analysis:

- A meta-analysis was attempted for those studies that included standard errors or standard deviations of the mean difference. However, the level of heterogeneity ($p < 0.001$) among the study designs made the inclusion of a summary estimate inappropriate.

Data Collection Summary:

Timing of Measurements

Studies reported in the tables include: 1983 to 2003.

Dependent Variables

- Total weight change
- Total body fat change
- Satiety
- Subsequent energy intake

Independent Variables

- Each study in this review includes both a relatively higher protein and a lower protein diet and compares the effects of each on a variety of outcomes

Control Variables

Description of Actual Data Sample:

Initial N: 50 articles

Attrition (final N): 50

Age: Not reported

Ethnicity: Not reported

Other relevant demographics:

Anthropometrics

Location: International studies

Summary of Results:

Key Findings

- There is convincing evidence that a higher protein intake increases thermogenesis and satiety compared to diets of lower protein content.
- The weight of evidence also suggests that high protein meals lead to a reduced subsequent energy intake.
- Some evidence suggests that diets higher in protein result in an increased weight loss and fat loss as compared to diets lower in protein, but findings have not been consistent.
- Convincing evidence exists that protein exerts an increased thermic effect when compared to fat and carbohydrate. Evidence is also convincing that higher protein diets increase satiety when compared to lower protein diets.
- Higher protein diets may facilitate weight loss when compared to a lower protein diet in the short term (within 6 months). But long-term data are limited.
- Exchange protein for carbohydrates has been shown to improve blood lipids, and in epidemiologic studies, higher protein diets have been associated with lower blood pressure and reduced risk of coronary heart disease.
- Although the optimal amount and sources of protein cannot be determined at this time, the weight of evidence suggests that in dietary practice, it may

- be beneficial to partially replace refined carbohydrate with protein sources that are low in saturated fat.
- Evidence suggests that diets higher in protein exert a larger effect on energy expenditure than diets lower in protein.
- The difference in thermic effect between the higher protein and the lower protein diets ranged from 0.8% of energy to 22% of energy, with protein always exerting the higher effect.
- The higher protein meal exerted a significantly higher thermic effect than the higher fat or higher carbohydrate meals.
- Of 14 studies that compared high protein to at least one other macronutrient, 11 found that the protein preload significantly increased subjective ratings of satiety.
- Many of the studies that found a higher satiety with protein utilized a very high protein preload (40% or higher).
- The evidence supports that meals higher in protein tend to increase satiety when compared to meals lower in protein, at least in the short term.
- Of 15 studies identified, 8 showed a significant decrease in energy intake after the higher protein preload. Several of the investigations that found a decreased energy intake with high protein preloads utilized a very high percent of energy from protein (50% or greater).
- There were some methodological differences between the studies that showed a decrease in energy intake after high protein preloads, compared with lower protein version, and those that did not.
- Overall, the weight of evidence suggests that higher protein intakes cause a decreased subsequent energy intake although the results are not entirely consistent. It appears that, the closer the methodology was to real life situations (real food vs. liquid, sense of taste unaltered, free living vs. whole body calorimeter), the more likely it was for protein to exert a significant decrease in subsequent energy intake.
- The majority of studies identified in this review did find a decreased subsequent energy intake with a higher protein preload. More research is needed in this area, with better agreement with regards to methodology across studies in order to shed further light on this question.
- Fifteen studies have been identified that measured absolute weight lost.
- Of the 7 studies that found a significantly greater weight loss with a higher protein diet, 5 were of a longer duration (6 months or longer).
- Of the 8 studies that found no significant difference in weight loss comparing higher and lower protein diets, half of them were of a relatively short duration (10 weeks or less) and small sample size (6–35 subjects).
- Overall, there is some evidence that high protein diets enhance weight loss compared to lower protein diets in the short term. It is important to realize that not all of the diets were isocaloric.
- In fact, all 5 of the investigations that utilized an ad lib dietary intake found significantly increased weight loss with the higher protein regimen.
- Several of the previously mentioned studies also looked at body composition to test the hypothesis that higher protein diets spare the lean body mass of those on energy restricted diets .
- Out of 10 studies identified, most found greater fat loss with the high protein diets in comparison to the lower protein diets, but only three studies found this difference to be statistically significant.
- There is little evidence that high protein diets pose a serious risk to kidney function in healthy populations.
- More susceptible groups such as diabetics and those with existing renal disease should exercise more caution with higher protein intakes.
- It appears that moderately high protein diets are not harmful to cardiovascular health and may indeed be beneficial.

Author Conclusion:

In conclusion, evidence suggests that higher protein diets may have beneficial effects on weight loss in the short term, although most of the studies have been small and inconclusive. More definitive evidence should wait for the results from ongoing long-term trials. Although the optimal amount and sources of protein cannot be determined at this time, the weight of evidence suggests that in dietary practice, it may be beneficial to partially replace refined carbohydrate with protein sources that are low in saturated fat.

Reviewer Comments:

Level of heterogeneity among the study designs made the inclusion of a summary estimate inappropriate, therefore review was qualitative in nature.

Research Design and Implementation Criteria Checklist: Review Articles

Relevance Questions

- | | | |
|----|-------------------------------------------------------------------------------------------------|-----|
| 1. | Will the answer if true, have a direct bearing on the health of patients? | Yes |
| 2. | Is the outcome or topic something that patients/clients/population groups would care about? | Yes |
| 3. | Is the problem addressed in the review one that is relevant to nutrition or dietetics practice? | Yes |
| 4. | Will the information, if true, require a change in practice? | Yes |

Validity Questions

- | | | |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 1. | Was the question for the review clearly focused and appropriate? | Yes |
| 2. | Was the search strategy used to locate relevant studies comprehensive? Were the databases searched and the search terms used described? | Yes |
| 3. | Were explicit methods used to select studies to include in the review? Were inclusion/exclusion criteria specified and appropriate? Were selection methods unbiased? | Yes |
| 4. | Was there an appraisal of the quality and validity of studies included in the review? Were appraisal methods specified, appropriate, and reproducible? | Yes |
| 5. | Were specific treatments/interventions/exposures described? Were treatments similar enough to be combined? | Yes |
| 6. | Was the outcome of interest clearly indicated? Were other potential harms and benefits considered? | Yes |
| 7. | Were processes for data abstraction, synthesis, and analysis described? Were they applied consistently across studies and groups? Was there appropriate use of qualitative and/or quantitative synthesis? Was variation in findings among studies analyzed? Were heterogeneity issues considered? If data from studies were aggregated for meta-analysis, was the procedure described? | Yes |
| 8. | Are the results clearly presented in narrative and/or quantitative terms? If summary statistics are used, are levels of significance and/or confidence intervals included? | Yes |
| 9. | Are conclusions supported by results with biases and limitations taken into consideration? Are limitations of the review identified and discussed? | Yes |
| 10. | Was bias due to the review's funding or sponsorship unlikely? | Yes |

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